COURSES OF STUDY
(Three Year Degree Course)
B.Sc. Geology Honours Part – III

THEORY PAPER – V
Full Marks – 100
Time – 3 hours

In all ***Ten*** questions are to be set (***five*** from Group A. ***three*** from Group B and ***two*** from Group C) and the students are required to answer ***five*** questions selecting ***at least one*** from each group.

GROUP – A
ECONOMIC GEOLOGY

- Introduction to ore minerals, gangue, ore, tenor, cut-off grade.
- Classification of ore deposits

- *Processes of formation of mineral deposits with special reference to :*
  - Magmatic Concentration,
  - Supergene Sulphide enrichment,
  - Hydrothermal and
  - Placer deposits.
- Brief idea of relationship between Plate Tectonics and mineral deposits.
- Prospecting – Geological, Geophysical and Geochemical.
- Elementary knowledge of Porphyry Copper.

- *Detailed study of the following economic mineral deposits of India –*
  - Iron, Basemetals (Copper, lead and zinc), Bauxite, Manganese, Mica, Coal and Petroleum, Atomic minerals
- A brief study of the *physical properties, chemical composition, mode of occurrence, uses and distribution* of following economic minerals in India : Galena, Graphite, Gypsum, Talc, Calcite, Fluorite, Apatite, Feldspar, Quartz, Topaz, Corundum, Chromite, Barite, Ilmenite, Rutile, Monazite, Garnet, Beryl, Kyanite, Sillimanite, Asbestos, Diamond, Fire Clay and China Clay

GROUP – B

HYDROGEOLOGY

- Hydrogeology : concept and scope.
- Hydrologic Cycle : Distribution of water in the earth's crust; Components of hydrologic cycle – evaporation, evapo-transpiration, precipitation, Infiltration and run-off.
- Definition and classification of subsurface water; Vertical distribution of groundwater – zone of aeration and zone of saturation. Origin and age of groundwater; Importance of groundwater.
- Types of groundwater – juvenile water, magmatic water, connate water, metamorphic water.
- Aquifers : unconfined, confined and leaky aquifers; water table and piezometric surface;
- Geological formations serving as aquifers;
- Properties of water-bearing formations : porosity, permeability, specific yield, specific retention, storage coefficient, hydraulic gradient;
- Springs and their types; Thermal springs;
- Ground water exploration : Geological and hydrologic studies : Exploratory drilling; Electrical Resistivity Surveying; Seismic Refraction Surveying;
- Chemical character of Groundwater: hardness, electrical conductance, pH, dissolved minerals; water quality requirements; drinking water standards;
- Geological provinces : Groundwater resources of Bihar, Occurrence of groundwater in hard rock terrain;

GROUP – C

FIELD GEOLOGY

- Basic idea of Field Geology
- Methods and techniques of sampling and geological mapping.
- Field equipments and their functions
- Interpretation of Topographical and Geological maps.

ENGINEERING GEOLOGY

- Engineering properties of rocks.
- Role of geology in Planning and construction of engineering projects – Dam site selection, Tunnels, Bridges & Road alignment.

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THEORY PAPER – VI

Full Marks – 100
Time – 3 hours

In all ***Ten*** questions are to be set (***six*** from Group A and ***four*** from Group B) and the students are required to answer ***five*** questions selecting ***at least two*** from each group.

GROUP – A
GENERAL GEOLOGY AND TECTONICS

- Concept of Diastrophism – Orogeny and Epeirogeny ; Isostasy
- Continental Drift –Wegener's Hypothesis, Evidences
- Sea Floor Spreading
- Plate Tectonics – concept & causes of plate tectonics
- Brief idea of :
    - Palaeomagnetism
    - Polar wandering
    - Island – Arc
    - Rift Valley
    - Palaeoclimate
- Mountains – Type, characteristics, and origin,
- Structure and tectonic evolution of the Himalayas
- Seismology and the internal structure of the earth ; Thermal history of the earth.
- Plate movement and Seismicity; Seismograph
- Seismic Bells of the earth, Seismicity in India.
- Radioactivity and its application in Geology

GROUP – B
GEOMORPHOLOGY

- Nature and scope of Geomorphology
- Fundamental concepts of geomorphology
- Applications of geomorphology
- Classification of geomorphic processes – weathering, mass – wasting and erosion.
- Concept of geomorphic cycle and their interpretation
- Landforms resulting from various processes – Fluvial, Eolian, Marine, Tectonic, Volcanic, Karst Topography
- Brief introduction of –
    - causes of rejuvenation
    - peneplanation
    - soil profile and
    - relief of ocean floor
- Drainage patterns and their significance.
- Comparative account of drainage characteristics of Peninsular and Extra-Peninsular India.
- Geomorphology of Chhotanagpur Plateau

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B.K. Mishra 7-7-15 7/7/15

THEORY PAPER – VII

Full Marks – 100
Time – 3 hours

In all ***Ten*** questions are to be set (***six*** from Group A and ***four*** from Group B) and the students are required to answer ***five*** questions selecting ***at least two*** from each group.

GROUP – A
STRATIGRAPHY

- Principles of Stratigraphy
- Methods of Stratigraphic Correlation,
- Brief idea about Lithostratigraphy, Biostratigraphy, Chronostratigraphy, Magneto-stratigraphy, Seismic and Sequence stratigraphy.
- Geological Time Scale
- A brief account of the stratigraphy of India with special reference to the *classification, distribution, lithology, fossil content and economic importance* of the following geological formations of India – Precambrian of Dharwar and Singhbhum, Cuddapah, Vindhyan, Permo-carboniferous of Salt Range, Triassic of Spiti,Gondwana, Jurassic of Kutch, Cretaceous of South India, Siwaliks and Tertiary of Assam
- Palaeogeography of Permo – carboniferous and Cretaceous periods.

GROUP – B
PALAEONTOLOGY

- Definition and sub-disciplines : Fossils; index fossils
- Preservation of fossils
- Uses of Fossils ; Life through ages;
- Theory of Evolution; Evolution of Man and Horse
- Invertebrate Palaeontology – morphology, classification and geological history of following groups.–
  Gastropoda, Lamellibranchia, Brachiopoda, Cephalopoda, Trilobita and Echinoidea
- Brief study of :
  - Suture line development of Ammonoids,
  - Dentition of Lamellibranchia,
  - Classification of Brachiopoda and
  - Evolutionary trends in Trilobita.
- Vertebrate Palaeontology – Stratigraphic distribution of Vertebrates in India; Siwalik vertebrate fauna.
- Palaeobotany – Fossil records of land plants and their stratigraphic distribution; Brief study of the Gondwana flora in India.
- Micropalaeontology ; Microfossils and their importance.

PAPER – VIII (PRACTICAL)
Full Marks – 100
(Practical – 80 and Field work - 20)

- Study and interpretation of geological maps, drawing of Geological sections.
- Completion of outcrops.
- Structural problems relating to dip and strike & thickness of beds, three-point problems.
- Prismatic compass and plane-table survey (Intersection & Closed Traverse methods)
- Megascopic study of important ore and economic minerals.
- Megascopic study of important Indian stratigraphic rocks.
- Preparation of stratigraphic maps of India showing distribution of Archaeans, Vindhyan, Gondwana and Tertiary
- Preparation of Palaeogeographic maps of Permo-carboniferous and Cretaceous periods.
- Morphological identification and drawing of the following fossils with special reference to their *morphological characters* and *geological age* – *Nummulites, Alveolina, Corals, Calceola, Zaphrentis, Cidaris, Hemicidaris, Micraster, Hemiaster, Productus, Spirifer, Terebratula, Rhynchonella, Cerithium, Turritella, Conus, Physa, Murex, Voluta, Arca, Pecten, Inoceramus, Spondylus, Ostrea, Gryphaea, Exogyra, Trigonia, Cardita, Perisphinctes, Gonatite. Ceratites, Nautilus, Orthoceras, Belemnites, Calemene, Phacops, Paradoxides, Glossopteris, Gangamopteris, Vertebraria, Senizoneura, Ptillophylum.*
- Geological Field work
- Sessional work

Book Recommended

1. *Jenson and Bateman* : Economic Mineral Deposits
2. *Prasad, U.* : Economic Geology
3. *Wadia* : Minerals of India
4. *Brown, C. and Dey, A.K.* : Indian Mineral Wealth
5. *Sinha and Sharma* : Mineral Economics
6. *Tarlings* : Economic Geology and Geotectonics
7. *Riley, Charles M.* : Our Mineral Resources
8. *Bagchi, Sengupta and Rao* : Elements of Prospecting and Exploration
9. *Kesler, Stephen E.* : Mineral Resources, Economics and the Environment
10. *Todd* : Groundwater Hydrology
11. *Karanth* : Hydrogeology
12. *Raghunath* : Hydrology
13. *Lahee, F.H.* : Field Geology
14. *Singh, Praveen* : Text Book of Engineering and General Geology
15. *Singh, S.* : Physical Geography
16. *Valdia, K.S.* : Aspects of Tectonics
17. *Wiley* : Dynamic Earth
18. *Steers, J.A.* : The Unstable Earth
19. *Worcester, P.G.* : A Text Book of Geomorphology
20. *Rice, R.J.* : Fundamentals of Geomorphology
21. *Thornbury, W.D.* : Principles of Geomorphology.

COURSES OF STUDY
(Three Year Degree Course)
B.Sc. Geology Honours Part –II
THEORY PAPER –III

Full Marks – 75
Time-3 hours

In all ***Ten*** questions are to be set and the students are required to answer ***five*** questions.

IGNEOUS PETROLOGY

- Introduction to Petrology-distinguishing features of three types of rocks
- Igneous Petrology : Definition. Form Texture and Structure of Igneous rocks and their petrological significance
- Magma : Definition, generation and crystallization of magma, Elementary idea of relationship between magma generation and Tectonic setting
- Bowen's Reaction Principle & its petrological significance
- Classification of Igneous rocks
- Diversity of Igneous Rocks.
- Introduction to Phase Rule, Study of the following Phase diagrams :

  Binary : Ab –An ; Ternary : Ab – An – Di.
- *Petrographic description of the following rock types* :

  Granite Rhyolite, Syenite, Nepheline-syenite, Monzonite, Granodiorite, Diorite, Pegmatite, Anorthosite, Gabbro, Dolerite, Basalt, Peridotite, Pyroxenite, Norite, Dunite, Trachyte and Andesite.

THEORY PAPER –IV

Full Marks – 75

Time-3 hours

In all ***Ten*** questions are to be set (***five*** from each group) and the students are required to answer ***five*** questions selecting **at least two** from each group.

Group-A

SEDIMENTARY PETROLOGY

- Introduction
- Processes of formation of sedimentary rocks
- Lithification and Diagenesis
- Textures of clastic and non-clastic sedimentary rocks
- Structures of sedimentary rocks -- Primary, Secondary, Biological
- Classification of sedimentary rocks
- Provenance
- *Petrographic description of the following rock types :*

  Conglomerate, Breccia, Sandstones – Orthoquartzite, Arkose, Greywacke, Limestone, Dolomite, Shale.

Group-B

METAMORPHIC PETROLOGY

- Introduction to metamorphism : Definition, aims and scope of study of metamorphic rocks
- Limitations of metamorphism- Diagenesis, metamorphism, anataxis, palingenesis
- Preliminary ideas of metamorphic differentiation, Prograde, Retrograde, and Poly-metamorphism, paired metamorphic belts, Index minerals
- Agents and kinds of metamorphism
- Textures and structures of metamorphic rocks
- Classification of metamorphic rocks
- Concept of Zones, Facies, Facies series, Grades and Isograds
- Plate tectonics and metamorphism
- Thermal metamorphism of argillaceous and calcareous rocks
- Regional metamorphism of argillaceous and calcareous rocks
- *Petrographic notes on the following metamorphic rocks :*

  Slate, Phyllite, Schists, Gneisses, Amphibolites, Marble, Quartzites, Hornfels, Charnockite, Khondalite, Eclogite, Kodurite and Skarns.

PRACTICALS
Full marks – 50
(Practial – 40 ; Sessional & Viva-voce-10)

- Megascopic study of the following rocks :
  - Granite, Syenite, Pegmatite, Diorite, Gabbro, Basalt, Rhyolite, Dunite, Trachyte, Obsidian, Pumice, Peridotite, Pyroxenite, Anorthosite, Norite, Schists, Gneisses, Marble, Charnockite, Phyllite, Amphibolite, Quartzite, Shale, Sandstone, Limestone, Conglomerate, Breccia.

- Microscopic study of the following rocks :
  - Granite, Syenite, Nepheline–syenite, Granodiorite, Diorite, Gabbro Dolerite, Basalt, Peridotite, Anorthosite, Charnockite, Schists, Gneisses, Amphibolite, Marble, Quartzite, Sandstone, Orthoquartzite, Arkose, Greywacke, Limestone, Shale.

Books Recommended :

1. *Tyrell, G.W.* : Principles of Petrology
2. *Huang* : Petrology
3. *Nockolds, Chinner and Kinox* : Petrology for students
4. *Harker* : Petrology for students
5. *Blatt, Ehler* : Petrology (Igneous, Sedimentary and Metamorphic)
6. *Bose, M.K.* : Igneous Petrology
7. *Mc Birney* : Igneous Petrology
8. *Hall* : Igneous Petrology
9. *Best, M.G.* : Igneous and Metamorphic Petrology
10. *Hyndman, W.D.* : Petrology of Igneous and Metamorphic Rocks
11. *Turner and Verhoogen* : Igneous and Metamorphic Petrology
12. *Hatch and Wells* : Petrology of the Igneous Rocks
13. *Philpotts* : Principles of Igneous and Metamorphic Petrology
14. *Yardley* : Introduction to Metamorphic Petrology
15. *Mason, Roger* : Petrology of the Metamorphic Rocks
16. *Pettijohn, F.* : Sedimentary Rocks
17. *Greensmith* : Petrology of the sedimentary Rocks
18. *Tucker* : Sedimentary Petrology
19. *William, Turner and Gilbert* : Petrography
20. *Sengupta, S.* : Introduction to Sedimentology
21. *Moorehouse* : The Study of Rocks in Thin Section
22. *Winkler, HGF* : Petrogenesis of Metamorphic Rocks
23. *Blatt, Tracy and Owens* : Petrology (Igneous, Sedimentary and Metamorphic) W.H. Freeman and Company, New York
24. *V.K. Verma* : Sedimentary Petrology

B.Sc. (SUBSIDIARY) Part –II

THEORY PAPER –II

Full Marks – 75
Time-3 hours

In all ***Ten*** questions are to be set (***five*** from each group) and the students are required to answer ***five*** questions selecting **at least two** from each group.

Group-A

IGNEOUS PETROLOGY

- Petrology-Definition, three-fold classification of rocks and their distinction.
- Igneous Petrology-Elementary knowledge about Magma, Magma types and its composition.
- Bowen's Reaction Principle
- Forms, Texture and Structure of Igneous Rocks.
- Classification of Igneous Rocks.
- Petrographic description of the following rock types :
    - Granite, Granodiorite, Syenite, Diorite, Gabbro, Dolerite, Basalt, Rhyolite.

METAMORPHIC PETROLOGY

- Metamorphism – Definition, agents and types.
- Textures and structures of Metamorphic rocks.
- Classification of Metamorphic rocks.
- *Petrographic study of the following metamorphic rocks* :
  Slate, Phyllite, Schist, Gneiss, Augen Gneiss, Amphibolite, Granulite, Charnockite, Marble, Quartzite.

SEDIMENTARY PETROLOGY

- Definition and formation of sedimentary rocks
- Textures of sedimentary rocks
- Study of important primary sedimentary structures
- Classification of sedimentary rocks
- Petrographic study of sandstone, limestone, shale, conglomerate, breccia

Group-B

ECONOMIC GEOLOGY

- Concept of ore, ore mineral, Gangue, Tenor of ores.
- An elementary idea of the processes of formation of mineral deposit with special reference to
  - magmatic concentration,
  - supergene suplhide enrichment,
  - placer deposits.
- *Study of the physical properties, chemical composition, distribution and uses of the following economic minerals :*

  Talc, Gypsum, Calcite, Fluorite, Apatite, Orthoclase, Quartz, Topaz, Corundum,Chromite, Beryl, Barite, Kyanite, Pyrolusite, Psilomelane, Mica, Hematite, Magnetite, Chalcopyrite, Bauxite, Graphite, Galena.

STRATIGRAPHY

- Definition, Principles of stratigraphy,
- Methods of stratigraphic correlation,
- Geological Time Scale,
- An outline of Indian stratigraphy with special reference to:
  - Precambrian of Singhbhum
  - Vindhyan supergroup
  - Gondwana supergroup
  - Siwaliks

PALAEONTOLOGY

- Definition- fossils, index fossils, trace fossils
- Conditions of fossilisation and Modes of Preservation,
- *Morphology and Geological History of the following* :

  Gastropoda, Lamellibranchia, Brachiopoda, Cephalopoda and Trilobita.

PRACTICAL

- Observation of the following economic minerals with reference to their physical properties :

  Talc, Gypsum, Calcite, Fluorite, Apatite, Topaz, Corundum, Beryl, Barite, Kyanite, Sillimanite, Hematite, Magnetite, Chromite, Chalcopyrite, Malachite, Azurite, Bauxite, Galena, Pyrite.
- *Megascopic study of the following Rocks :*

  Granite, Syenite, Pegmatite, Gabbro, Dolerite, Basalt, Rhyolite, Schist, Gneiss, Marble, Charnockite, Sandstone, Limestone, Shale, Phyllite, Conglomerate, Breccia.
- *Microscopic study of the following rocks :*

  Granite, Gabbro, Dolerite, Basalt, Charnockite, Schist, Gneiss, Sandstone, Limestone, Quartzite.

- *Morphological identification and drawing of the following Fossils : Micraster, Productus, Spirifer, Terebratula, Rhynchonella, Turritella, Conus, Murex, Physa, Voluta, Arca, Pecten, Ostrea, Gryphea, Cardita, Nautilus, Orthoceras, Glossopteris, Gangamopteris, Ptilophylum, Vertebraria.*

Books Recommended :

1. *Tyrell, G.W.* : Principles of Petrology
2. *Mukherji, P.K.* : Text Book Of Geology
3. *Hatch and Wells* : Petrology of the Igneous Rocks
4. *Mason, Roger* : Petrology of the Metamorphic Rocks
5. *Pettijohn, F.* : Sedimentary Rocks
6. *Sengupta, S.* : Introduction to Sedimentology
7. *Moorehouse* : The Study of Rocks in Thin Section
8. *Woods, Henry* : Invertebrate Palaeontology
9. *Wadia, D.N.*: Geology of India and Burma
10. *Prasad, U.* : Economic Geology
11. *A.K.Sen* : Practical Geology

COURSES OF STUDY
(Three Year Dégree Course)
B.Sc. Geology Honours Part-I
THEORY PAPER-I
Full Marks-75
Time – 3 hours

In all ***Ten*** questions are to be set (***six*** from Group A and ***four*** from Group B) and the students are required to answer ***five*** questions selecting ***at least two*** from each group

Group – A
GENERAL AND PHYSICAL GEOLOGY

- Introduction : Aim, application and various branches of Geology
- The Earth and the solar system, important physical parameters and properties of the planet.
- Elementary Knowledge of earth's atmosphere, hydrosphere, lithosphere and biosphere.
- Origin of the earth
- Age of the earth
- Geological Time Scale
- Internal structure and composition of the earth
- Elementary idea of the Plate Tectonics
- Earthquakes --Causes, intensity, magnitude and effects
- Seismograph, Seismicity in India
- Volcano -- types, distribution and products
- Physiographic divisions and Tectonic framework of India
- Surface processes: Weathering and Erosion, Normal Cycle of Erosion
- Geological work of Rivers, Underground water, Wind, Glaciers.
- Causes of glaciation, evidences of ice age
- Coral Reef

Group – B
STRUCTURAL GEOLOGY

- Definition and objectives of structural geology.
- Elementary concept of structural geology- idea of strain and stress in rocks.
- Stratification and bedding, Attitude of Beds, Outcrops and outcrop patterns, Outliers and Inliers, Dip & strike,
- Clinometer compass and its uses.
- Folds – Definition, Classification, causes, recognition and importance
- Faults – Definition, Classification, causes, recognition
- Effects of Fault on outcrops & folded strata
- Unconformity – Defnition, types, recognition and geological significance.

- Joints – Definition, types & classification
- Lineation, Foliation – Definition and types.
- Criteria for the recognition of top and bottom of bed

THEORY PAPER-II

Full marks – 75

Time – 3 hours

In all ***Ten*** questions are to be set (***Five*** from each group) and the students are required to answer ***five*** questions selecting ***at least two*** from each group

Group – A
MINERALOGY

- Minerals – Definition and physical properties – form, colour, streak, luster, cleavage, fracture, hardness, and specific gravity
- Isomorphism, Polymorphism and Pseudomorphism
- Structure of silicates
- A detailed study of following rock forming mineral groups with reference to their *composition, structure, physical* and *optical properties* and *paragenesis:*

  Quartz, Feldspar, Pyroxene, Amphibole, Mica

- *Detailed study of the following minerals* – Garnet, Olivine, Nepheline, Talc, Gypsum, Calcite, Fluorite, Apatite, Beryl, Topaz, Corundum, Barite, Kyanite, Sillimanite, Tourmaline.

Group – B
CRYSTALLOGRAPHY

- Definition and morphology of crystal, crystal notations,
- Brief idea of space lattice,
- Symmetry elements : Plane-, Axis- and Centre of symmetry
- Parameter, indices and symbols
- Laws of crystallography
- Contact Goniometer
- Stereographic Projections
- Study of the following Crystal systems:
  - Isometric system,
  - Tetragonal system,
  - Hexagonal system,
  - Orthorhombic system,
  - Monoclinic system,
  - Triclinic system
- Crystal habits and twinning, laws of twinning

OPTICAL MINERALOGY

- Elementary concepts of light, Propagation of light through minerals.
- Polarization, Double refraction.
- Construction of Nicol Prism,
- Petrological Microscope and its function.
- Isotropism and Anisotropism, Optical indicatrix

- Important optical properties – R.I., Pleochroism, Pleochroic haloes, Extinction and extinction angle, Birefringence, Interference colours
- Behaviour of convergent polarized light in Uniaxial and Biaxial minerals.
- Optical Accessories -- Mica plate, Gypsum plate and Quartz wed

PRACTICAL

Full Marks – 50 (Practical – 40 marks, Sessional and viva – 10 marks)

- Study of geological maps, drawing of geological section and description of their geological history.
- Clinographic Projection of :

Isometric System – Cube, Octahedron, Rhombdodecahedron, Pyritohedron, Trapezohedron and Tetrahedron (+ve and –ve)

Tetragonal System – 1st and 2nd order Prism with Basal pinacoids, 1st and 2nd order Pyramids Zircon, Vesuvianite, Cassiterite

- Stereographic Projection of : Zircon, Vesuvianite, Cassiterite and Barite
- Megascopic study of ores and common rock forming minerals
- Microscopic study of common rock forming minerals

Books recommended :

1. *Holmes, A.* : Principles of Physical Geology.
2. *Longwell and Flint* : Introduction to Physical Geology
3. *Dutta, A.K.* : An Introduction to Physical Geology
4. *Singh, S.* : Physical Geography
5. *Singh, Praveen* : Textbook of Engineering and General Geology
6. *Siddarth, K.* : Earth's Dynamic Surface
7. *De Sitter, L.U.* : Structural Geology
8. *Billings, M.P.* : Structural Geology
9. *Platt and Challinov* : Simple Geological Structure
10. *Chiplonkar, G.N.* : Geological Maps
11. *Lahee, F.H.* : Field Geology
12. *Turner, F.J. and Weiss, L.E.* : Structural Analysis of Metamorphic Tectonics

B.Sc. Geology Subsidiary Part -I

Theory Paper – I

Full Marks – 75

Time – 3 hours

In all ***Ten*** questions are to be set (***Five*** from each group) and the students are required to answer ***five*** questions selecting ***at least two*** from each group.

Group – A

PHYSICAL GEOLOGY

- Aim, application and various branches of Geology
- Earth as a planet - Its size, shape, origin and age.
- Internal structure of the earth.
- Earthquake – Causes, distribution and effects.
- Elementary idea ofthe earth - Atmosphere, Hydrosphere, Lithosphere & Biosphere.
- Surface processes : Weathering and Erosion,
- Geological work of : River, Glaciers, Underground water and Wind.
- Volcanoes : types, products and distribution

STRUCTURAL GEOLOGY

- Elementary concepts of stratification and bedding
- Dip and strike
- Clinometer Compass
- Fold – definition, classification & types
- Fault – definition, classification
- Unconformity – definition, types
- Joints - definition, types

Group – B

MINERALOGY

- Minerals – Definition and physical properties – forms, colour, streak, luster, cleavage, fracture, hardness, specific gravity etc.
- Moh's scale of hardness
- Isomorphism and Polymorphism.
- Structural Classification of silicates
- Mineralogy of important group of rock forming minerals with reference to *composition, structure, physical and optical properties* –

  Feldspar, Pyroxene, Amphibole, Mica

- Study of physical and optical properties, chemical composition of following minerals-
- Quartz, Olivine, Garnet, Talc, Gypsum, Calcite, Fluorite, Apatite, Topaz, Corundum.

CRYSTALLOGRAPHY

- Crystal – Definition, faces, edges & solid angles
- Crystallographic axis, crystallographic planes, Crystal notations.
- Symmetry elements : axis-, plane- and centre of symmetry
- Contact goniometer and its use
- Laws of crystallography
- Crystal System, Study of the normal class of the following crystal systems:

Isometric system, Tetragonal system, Orthorhombic system

OPTICAL MINERALOGY

- Propagation of light through minerals
- Double refraction and polarization
- Construction of Nicol Prism
- Petrological Microscope and its function
- *Study of important optical properties* – R.I., Relief, Birefringence, Pleochroism, Interference colour and Extinction.

PRACTICAL

Full Marks – 25 (Practical – 20 Marks and Sessional & Viva – 5 Marks)

- Study of simple geological maps, drawing of geological section and description of their geological history.
- *Crystal drawing of the following forms* : Cube, Octahedron, Rhombdodecahedron, 1st and 2nd order Prisms and Pyramids of Tetragonal System, Zircon
- *Study of Physical properties of the following minerals* : Quartz, Orthoclase, Microcline, Feldpars, Muscovite, Biotite, Hornblende, Tremolite, Actinolite, Olivine, Calcite, Gypsum, Talc, Fluorite, Apatite, Topaz, Corundum, Baryte, Kyanite, Tourmaline, Garnet, Magnetite, Hematite, Chalcopyrite, Pyrite, Bauxite, Chromite, Pyrolusite, Psilomelane.
- Microscopic Study of the common rock-forming minerals.

Books recommended :

1. *Holmes, A.* : Principles of Physical Geology.
2. *Dutta, A.K.* : An Introduction to Physical Geology
3. *Singh, S.* : Physical Geography
4. *Singh, Praveen* : Textbook of Engineering and General Geology
5. *Siddarth, K.* : Earth's Dynamic Surface
6. *De Sitter, L.U.* : Structural Geology
7. *Billings, M.P.* : Structural Geology
8. *Platt and Challinov* : Simple Geological Structure
9. *Lahee, F.H.* : Field Geology
10. *Mukherjee, P.K.*: Text Book of Geology
11. *Dana & Ford* : Textbook of Mineralogy
12. *H.H.Read* : Rutley's Mineralogy
13. *Berry Mason* -- Elements of Mineralogy
14. *Kerr, P.F.*– Optical Mineralogy